Offshore Crude Oil Control System Using Solar Energy

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- **Abstract:**

This project shows the main points of the pollution of oil spills in marine surroundings. By exploitation solar power we are able to build it a lot of positive effort towards the surroundings. Some quantity of spill at the incorrect time or wrong season and in exceedingly sensitive surroundings might prove way more harmful. Marine oil spill could be a significant issue of off-shore oil drilling, blowouts, pipeline breakages, ship collusions or grounding and over filling of tankers. Over three million metric a lot of oil contaminates the ocean waters per annum. They have terribly dangerous effects on coastal surroundings.

There are many ways to manage this pollution. The spills are controlled by booms, skimmers, sorbents, and dispersants and controlled burning processes. A number of these method don't seem to be altogether economical and Eco friendly. To overcome these all issues regarding the ocean shorelines, our project goes to figure for that exploitation offshore oil system supplied with solar power. All the system goes to figure on solar power during this project. Because of this project we are able to collect and store the oil spills by employing a mechanical assembly in an exceedingly tank.

- **Introduction:**

Crude oil can be defined as a naturally occurring material, unrefined petroleum product which is made of hydrocarbons deposits and other organic materials. It can't be replaced naturally with the other things. Crude oil is a nonrenewable resource. The whole world is totally dependent on crude oil. On the other side, it might be hugely responsible for the sea pollution. To transport this oil from country to country or one place to another place is sea. When they are transporting this oil through the sea, because of some reasons accident might happen. If we check the history of the world till today, there are number of cases are available which shows us so many accidents, losses and marine pollution.

The main aim of our project is to provide a pollution free, medium cost and very efficient system to control all such problems. Also it consumes energy from nature that is Sun. Initially, the oil detector circuit which the very first part, will detect whether it is oil or water. If the response is oil then mechanical assembly will, start collecting the crude oil from the sea floor. It will collect the oil in a tank. Tank level is monitored using ultrasonic sensor. When tank gets full it will send a message to the user on phone or computer by using the controller. Also one can find the location of the working boat by using latitude and longitude method. This method would help in developing smart boats using IOT technology, as well as finding its applications in industries.

- **Components Used:**

1. Raspberry Pi:

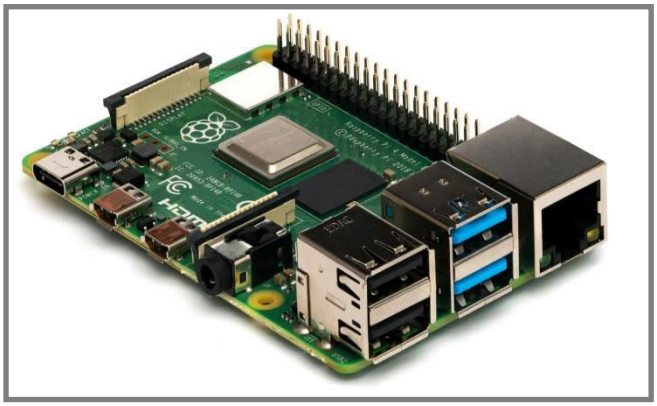

Figure1: Raspberry Pi 3B+

Raspberry pi is the heart of our project. The Raspberry Pi hardware has evolved through several versions that feature variations in memory capacity and peripheral-device support.

Block Diagram:

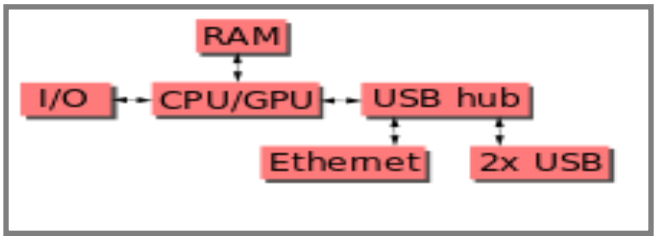

Figure2: Block representation working of Raspberry Pi 3 B+

ThePi 3 B+ has a quad-core Broadcom BCM2837B0 and a Cortex-A53 processor clocked at 1.4 GHz. It gives you full 64-bit support and offers more power than previous iterations of the Pi, including the immediate predecessor, the Pi 3. There's 1GB of LPDDR2 SDRAM for memory and a micro SD card slot that you'll use for storage and loading, for whichever operating system you want to put on it.

Specifications of Raspberry Pi 3 B+:

- Quad core 64-bit processor clocked at 1.4GHz
- 1GB LPDDR2 SRAM
- Dual-band 2.4GHz and 5GHz wireless LAN
- Bluetooth 4.2 / BLE
- Higher speed Ethernet up to 300Mbps
- Power-over-Ethernet capability (via a separate Poe HAT)

Figure3: Raspberry Pi 3B+

Operation:

Various operating systems for the Raspberry Pi can be installed on a Micro SD, MiniSD or SD card, depending on the board and available adapters; seen here is the Micro SD slot located on the bottom of Raspberry Pi board.The Raspberry Pi Foundation provides Raspbian, a Debian-based (32-bit) Linux distribution for download Ubuntu, Windows 10 IoT Core, RISC OS, and specialized media center distributions. It promotes Python and Scratch as the main programming languages, with support for many other languages. The default firmware is closed source, while an unofficial open source is available. Many other operating systems can also run on the Raspberry Pi. Third-party operating systems available via the official website include Ubuntu MATE, Windows 10 IoT Core, RISC OS and specialized distributions for the Kodi media center and classroom management. The formally verified microkernel seL4 is also supported.

2. GPRS Module:

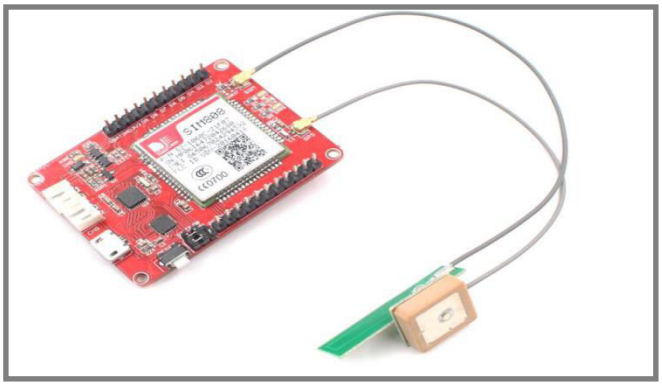

Figure4: GPRS module

- General Packet Radio Service
- Constant connectivity
- Data rate up to 56 to 114 Kbps
- Standardized by ETSI
- Provide data packet delivery service
- Volume based billing

GPRS or General Packet Radio Service is an extension of the GSM Network. GPRS is an integrated part of the GSM Network which provides an efficient way to transfer data with the same resources as GSM Network. Originally, the data services (like internet, multimedia messaging etc.) in the GSM Network used a circuit – switched connection. In this type, the access time for the network is long and the charges for the data were based on the connection time. Also, this type of connection is not suitable for transmitting bursts of data. With the integration of GPRS, a packet – switching based data service, in to the GSM Network, the scene of data services has changes. In GPRS based packet – switching networks, the user device doesn't hold the resources for a continuous time but efficiently uses a common pool. The access time in GPRS is very small and the main advantage is that it allows bursts of data to be transmitted. Also, the charges for data are based on the usage and not on the connection time.

3. Ultrasonic Sensor:

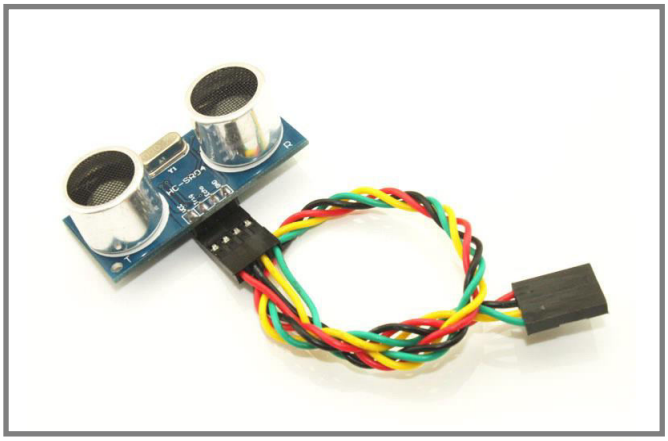

Figure5: Ultrasonic sensor hc-sr04

- Supply voltage 5V
- Supply current 15 mA
- Measure distance up to 2cm to 400cm
- Modulation frequency: 40Hz

The ultrasonic sensor works on the principle of SONAR and RADAR system which is used to determine the distance to an object. An ultrasonic sensor generates the high-frequency sound (ultrasound) waves. When this ultrasound hits the object, it reflects as echo which is sensed by the receiver. By measuring the time required for the echo to reach to the receiver, we can calculate the distance. This is the basic working principle of Ultrasonic module to measure distance. In ultrasonic module HCSR04, we have to give trigger pulse, so that it will generate ultrasound of frequency 40 kHz. After generating ultrasound i.e. 8 pulses of 40 kHz, it makes echo pin high. Echo pin remains high until it does not get the echo sound back. So the width of echo pin will be the time for sound to travel to the object and return back. Once we get the time we can calculate distance, as we know the speed of sound.HC-SR04 can measure up to range from 2 cm - 400 cm.

4. DC Motor:

Figure6: Diagram of DC motor

- Operating speed up to 1000 to 5000 rpm
- 60-75% efficiency rate
- High starting torque

A Direct Current (DC) motor is a rotating electrical device that converts direct current, of electrical energy, into mechanical energy. An Inductor (coil) inside the DC motor produces a magnetic field that creates rotary motion as DC voltage is applied to its terminal. Inside the motor is an iron shaft, wrapped in a coil of wire. This shaft contains two fixed, North and South.

5. Solar Panel:

Figure8: Solar panel

- Saves electricity
- Low maintenance
- High efficiency
- Consistent power source

The term **solar panel** is used colloquially for a photo-voltaic (PV) module.A PV module is an assembly of photo-voltaic cells mounted in a frame work for installation. Photo-voltaic cells use sunlight as a source of energy and generate direct current electricity. A collection of PV modules is called a PV Panel, and a system of Panels is an Array. Arrays of a photovoltaic system supply solar electricity to electrical equipment.

6. Moisture sensor:

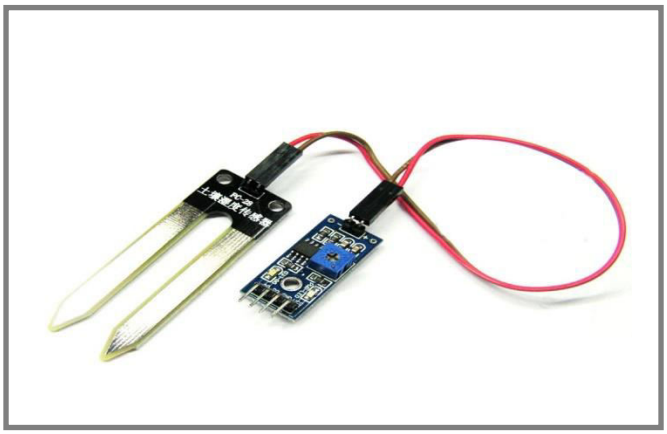

Figure7: Moisture sensor

- Working Voltage:**5V**
- Working Current:<20mA
- Interface type:Analog
- Working Temperature:10°C~30°C

Moisture sensor is used to measure the water content(moisture). Moisture Sensor uses capacitance to measure dielectric permittivity of the surrounding medium. The sensor creates a voltage proportional to the dielectric permittivity, and therefore the water content of the soil. The sensor averages the water content over the entire length of the sensor.

• Working:

Raspberry pi is working as main controller for this project. The moisture sensor we can use to detect the presence of oil in the water considering and comparing its analog output voltage. It will compare the values in water with oil and water without oil. It will be having some analog output values for comparison that we get from analog to digital converter used externally. When sensor detects oil, the controller will trigger to drive the motor where the collecting system is provided. The specially designed mechanical assembly will collect offshore oil will drive with that motor. Then, oil will be collected into the tank and tank level will be monitored using ultrasonic sensor. We can send the data which is collected by the ultrasonic sensor to the user by using all the circuitry. The GPRS module is used to send location and message to the computer.

• Algorithm:

1. By using moisture sensor presence of oil will be detected by comparing analog output values.If oil gets detected motors will start rotating and oil will be collected.
2. GPRS module will get location.
3. Ultrasonic sensor monitors level of tank where oil is collected.
4. GPRS module will send message whether tank is full or empty.

• Flowchart:

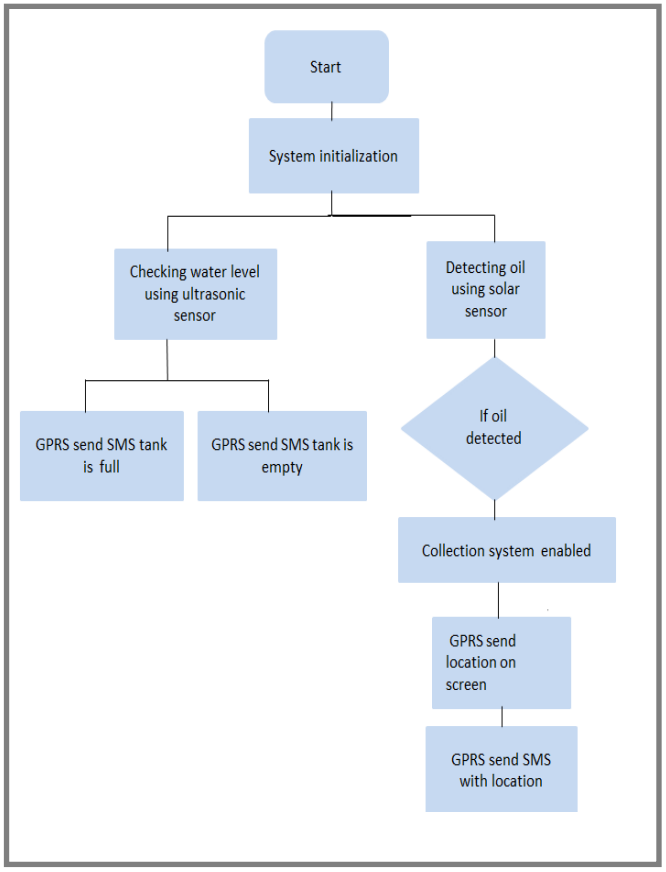

Figure: Work flow diagram of implemented system

• Result and Discussion:

The designed system includes the detection and store the oil from shorelines. With the help of technology tends to detect the Oil, and also GPRS technology for tracking the system in sea or ocean. Also tank level is displayed in which we store the oil, for user convenience via SMS.

The system we had implemented is just a model, for the actual practical on seafloor we have to add some extra feature for the actual result. The main advantage of our system is that we are a using solar battery charging system to give power to the system. We are using it to make the project more ecofriendly. Our only regret in this system is that our project needs more hardware, and

needs to be maintained. Future vision would need to reduce the hardware component. The overall system met most of its goals, and we are happy with that. The results obtained from our developed system are as below.

• Conclusion:

The system we had developed is very essential to prevent oil pollution at shorelines, also an advanced system as compared to traditional methods of separating the oil from the sea. The developed system in the paper is medium cost and done all the action quickly. It also helps to maintain a healthy marine environment. To make it more attractive and convenient for users, Solar tracker may be used for more energy collection and some additional features can be added.

• References:

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